

IN THE CLAIMS:

1-37. **(Canceled).**

38. **(Previously added/Currently amended)** An LED lamp for generating incoherent visible light, comprising:
an inorganic semiconductor structure comprising a lower semiconductor layer having a lower face thereof and an upper semiconductor layer having an upper face thereof, said lower and upper semiconductor layers forming a diode and an active region between said layers generating light, said structure having outer side faces (25) surrounding the structure and a plane generally parallel to said lower face defining a reference plane;

means ~~passing~~ harvesting vertical light from said active region ~~out of said lamp;~~

at least one metal conductor on said semiconductor structure electrically connected with said upper semiconductor layer;

a plurality of cavities in said semiconductor structure, each cavity extending from said upper face into said semiconductor structure and each containing a metal part that is in electrical contact with said lower semiconductor layer and that is distant from said outer side faces; said semiconductor structure being arranged to have several light-extraction surfaces for enhancing release of light from the semiconductor structure, said light-extraction surfaces being distant from said outer side faces and inclined to said reference plane, LED light propagating in the



RECEIVED
JUL - 8 2003
TECHNOLOGY CENTER 2800

semiconductor structure being diverted at said light-extraction surfaces;
and

electrical interconnection for causing the metal parts in said cavities to pass current together when the lamp is turned on.

39. **(Previously added)** An LED lamp according to claim 38 wherein side walls of said cavities provide at least some of said light-extraction surfaces.

40. **(Previously added)** An LED lamp according to claim 38 wherein said light-extraction surfaces are side walls of trenches.

41. **(Previously added)** An LED lamp according to claim 38 including a conductor layer in electrical contact with said upper semiconductor layer, the conductor layer reducing voltage drops in the upper semiconductor layer.

42. **(Previously added)** An LED lamp according to claim 41 wherein said conductor layer is of metal.

43. **(Previously added)** An LED lamp according to claim 38 including a substrate that is light-passing to visible light and over which at least one of said semiconductor layers has been grown.

44. **(Previously added)** An LED lamp according to claim 42 wherein said conductor layer is light-passing by being thin.

45. **(Previously added)** An LED lamp according to claim 38 wherein said metal parts serve as reflectors for light generated by said active region.

46. **(Previously added)** An LED lamp according to claim 38 wherein said lightextraction surfaces are oblique to said reference plane.

47. **(Previously added)** An LED lamp according to claim 38 wherein there are islands of said upper face defined by said light-extraction surfaces.

48. **(Previously added)** An LED lamp according to claim 38 including amorphous material at said light-extraction surfaces.

49. **(Previously added)** An LED lamp according to claim 38 wherein there are cavities that cut through said semiconductor structure.

50. **(Previously added)** An LED lamp according to claim 38 wherein each of said light-extraction surfaces meets an associated portion of said upper face at an angle measured through semiconductor of at least 90 degrees.

51. **(Previously added)** An LED lamp according to claim 38 including meandering conductors on said semiconductor structure.

52. **(Previously added)** An LED lamp according to claim 38 including a heat sink less than 50 microns away from said active region.

53. **(Previously added)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising a lower semiconductor layer and an upper semiconductor layer, said lower and upper semiconductor layers forming a diode and an active region between said layers generating light, said structure having outer side faces surrounding the structure;

LED portions within said semiconductor structure, each LED portion provided with an associated conductor for energizing the portion and an associated electrical link (71) in series with the associated conductor,

some of said LED portions being faulty and having their associated links deliberately disrupted;

electrical connections for energizing several of said LED portions together; and

wherein said semiconductor structure has light-extraction surfaces arranged for harvesting light from said semiconductor structure, said light-extraction surfaces being distributed distant from said outer side faces and being inclined to said active region, light generated in the semiconductor structure being diverted at said light-extraction surfaces.

54. **(Previously added)** An LED lamp according to claim 53 wherein said disrupted links are disrupted fuses.

55. **(Previously added)** An LED lamp according to claim 53 wherein said disrupted links are on said semiconductor structure.

56. **(Previously added/Currently amended)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising: a lower semiconductor layer having a lower face thereof; an upper semiconductor layer grown over said lower semiconductor layer and having an upper face thereof, said lower and upper semiconductor layers forming a diode; and an active region between said layers generating light a substantial proportion of which propagates parallel to said active region guided by internal reflections at said upper and lower faces, said structure having outer side faces surrounding the structure;

a conductor layer ~~covering and~~ in electrical contact with substantially all of the top of said upper semiconductor layer;

means harvesting vertical light from said active region;

~~a plurality of meandering tracks on said lower semiconductor layer~~
~~at least one of which has a portion thereof positioned between light~~
~~generating parts of said semiconductor structure,~~

a plurality of spaced-apart conductor parts distributed about the
semiconductor structure, each of said conductor parts being in electrical
contact with said lower semiconductor layer and positioned between light
generating portions of said semiconductor structure as viewed normal to
said layers;

electrical connection for causing said conductor parts to pass
current to said lower semiconductor layer together when the lamp is
turned on; and

wherein said semiconductor structure is arranged to have several
light-extraction surfaces for release of ~~said guided light from the~~
~~semiconductor structure~~ that is generated under said conductor layer and
guided by said reflections, said light-extraction surfaces being distant
from said outer side faces, ~~and~~ inclined to said active region, and each
meeting at least one of said lower and upper faces.

57. **(Previously added/Currently amended)** An LED lamp
according to claim 56 wherein at least one of said ~~tracks~~ conductor parts
comprises a conductor finger.

58. **(Previously added)** An LED lamp according to claim 56
including amorphous translucent material at said light-extraction surfaces.

59. **(Previously added)** An LED lamp according to claim 56
wherein said upper face is within 10 microns of said lower face.

60. **(Previously added)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising: a lower semiconductor layer having a lower face thereof; an upper semiconductor layer grown over said lower semiconductor layer and having an upper face thereof, said lower and upper semiconductor layers forming a diode; and an active region between said layers generating light a substantial proportion of which propagates parallel to said active region guided by internal reflections at said upper and lower faces, said structure having outer side faces surrounding the structure;

DI
a layer of material translucent to visible light and of lower refractive index than said lower semiconductor layer below the lower semiconductor layer, the translucent layer acting as a reflector for said guided light;

a semiconductor substrate of higher refractive index than said layer of translucent material below the layer of translucent material, the substrate passing vertical light from said active region;

a conductor layer covering and in electrical contact with said upper semiconductor layer;

a plurality of spaced-apart opaque conductors on said semiconductor structure for energizing one of said upper and lower semiconductor layers, at least one of the opaque conductors appearing between light-generating portions of said semiconductor structure as viewed normal to said reference plane;

electrical connection causing said opaque conductors to pass current to said semiconductor structure together when the lamp is turned on; and

wherein vertical light from said active region passes between a pair of said opaque conductors and wherein said semiconductor structure is arranged to have several light extraction surfaces for release of said guided light from the semiconductor structure, said light-extraction surfaces being distant from said outer side faces and inclined to said reference plane for diverting said guided light for output from the semiconductor structure.

61. **(Previously added)** An LED lamp according to claim 60 wherein said conductor layer is light-passing.

62. **(Previously added)** An LED lamp according to claim 60 including amorphous material at said light-extraction surfaces.

63. **(Previously added)** An LED lamp according to claim 60 wherein said light extraction surfaces are side walls of cavities that extend into said lower semiconductor layer.

64. **(Previously added)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising a lower semiconductor layer and an upper semiconductor layer, said lower and upper semiconductor layers forming a diode and an active region between said layers generating light, said structure having outer side faces surrounding the structure;

LED portions within said semiconductor structure each having an anode and a cathode, the cathode of one of the portions being metallically connected to the anode of another of the LED portions;

electrical connections for energizing several of said LED portions together; and

wherein said semiconductor structure has light-extraction surfaces arranged for harvesting light from said semiconductor structure, said light-extraction surfaces being distributed distant from said outer side faces and being inclined to said active region, light generated in the semiconductor structure being diverted at said light-extraction surfaces.

65. **(Previously added)** An LED lamp according to claim 64 including a first set of said LED portions electrically connected in parallel; a second set of said LED portions electrically connected in parallel; and electrical connection for driving said sets in series.

66-74. **(Canceled)**.

75. **(Previously added/Currently amended)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising: a lower semiconductor layer having a lower face thereof; an upper semiconductor layer having an upper face thereof, said lower and upper semiconductor layers forming a diode; and an active region between said layers generating light, a plane generally parallel to said lower face defining a reference plane; means harvesting vertical light from said active region;

a plurality of opaque conductor parts in electrical contact with said upper semiconductor layer;

~~a plurality of light-extraction grooves provided in said semiconductor structure each having first and second opposite side walls, the first side wall being light passing and oblique to said reference plane~~

~~and the second side wall comprising a metallic reflector arranged for reflecting light passing through the first side wall; and~~

a plurality of grooves provided in said semiconductor structure for light-extraction, each having a light-emitting side wall that meets said upper face and that is inclined to the upper face by an obtuse angle measures through semiconductor; each of the grooves containing a metallic reflector arranged for redirecting light emanating from the light emitting side wall; and

electrical connection for causing currents to be fed to said upper semiconductor layer via said opaque conductor parts when the lamp is turned on.

76. **(Previously added/Currently amended)** An LED lamp according to claim 75 including a reflector below said lower face receiving light reflected by one or more of said ~~first~~ light-emitting side walls.

77. **(Previously added/Currently amended)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising: a lower semiconductor layer having a lower face thereof; an upper semiconductor layer having an upper face thereof, said lower and upper semiconductor layers forming a diode; and an active region between said layers generating light, a plane generally parallel to said lower face defining a reference plane; means harvesting vertical light from said active region;

a plurality of opaque conductor parts in electrical contact with said upper semiconductor layer and between which light passes;

~~a plurality of light extraction grooves provided in said semiconductor structure each having first and second opposite side walls, the first side wall being light passing and the second side wall comprising a metallic reflector arranged for reflecting light passing through the first side wall, said metallic reflector being part of a concave metallic reflector that reflects some light rays from the light passing wall at least twice successively; and~~

a plurality of grooves provided in said semiconductor structure for light-extraction, each of the grooves having a light emitting side wall and containing an associated metallic reflector that reflects some rays from the light emitting wall at least twice successively; and

electrical connection for causing currents to be fed to said upper semiconductor layer via said opaque conductor parts when the lamp is turned on.

78. **(Previously added/Currently amended)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising: a lower semiconductor layer having a lower face thereof; an upper semiconductor layer having an upper face thereof, said lower and upper semiconductor layers forming a diode; and an active region between said layers generating light; means harvesting vertical light from said active region;

a plurality of opaque conductor parts in electrical contact with said upper semiconductor layer and between which light passes;

~~a plurality of light-extraction grooves excavated in said semiconductor structure each having first and second opposite side walls, the first side wall being light passing and the second side wall comprising a metallic reflector arranged for reflecting light passing through the first side wall; and~~

a plurality of light-extraction grooves excavated in said semiconductor structure each having a side wall that emits light and each containing a metallic reflector for deflecting the emitted light; and

electrical connection for causing currents to be fed to said upper semiconductor layer via said opaque conductor parts when the lamp is turned on.

79. **(Previously added)** An LED lamp according to claim 78 including a light passing conductor layer in electrical contact with said upper face.

80. **(Previously added)** An LED lamp according to claim 78 including a light passing substrate under said semiconductor structure and a reflector under said substrate redirecting downward light generated by said active region.

81. **(Previously added)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising: a lower semiconductor layer having a lower face thereof; an upper semiconductor layer having an upper face thereof, said lower and upper semiconductor layers forming a diode; and an active region between said layers generating light;

means harvesting vertical light from said active region;
a plurality of opaque conductor parts in electrical contact with said upper semiconductor layer and between which light from said active region passes;

a plurality of light-extracting trenches in said semiconductor structure, at least one of the trenches being inclined to another of the trenches by an acute angle; and

electrical connection for causing currents to be fed to said upper semiconductor layer via said opaque conductor parts when the lamp is turned on.

82. **(Previously added)** An LED lamp according to claim 81 wherein said trenches form triangular areas in said upper face.

83. **(Previously added)** An LED lamp according to claim 81 including a light passing conductor layer in electrical contact with said upper face.

84-91. **(Canceled)**

92. **(Previously added/Currently amended)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising: a lower semiconductor layer having a substantially flat lower face thereof; an upper semiconductor layer grown over said lower semiconductor layer and having a substantially flat upper face thereof, said lower and upper semiconductor layers forming a diode; and an active region between said layers generating light a substantial proportion of which propagates parallel to said active region guided by internal reflections at said upper

and lower faces, said structure having outer side faces surrounding the structure;

a conductor layer ~~covering and~~ in electrical contact with substantially all of the top of said upper semiconductor layer;

at least one metal conductor electrically ~~connected~~ in contact with an underlying portion of said lower semiconductor layer;

means harvesting upward and downward vertical light from said active region; and

wherein said semiconductor structure is arranged to have several ~~distributed~~ light-extraction surfaces ~~for~~ surfaces distributed about the semiconductor structure for release of said guided light from the semiconductor structure, said ~~lightextraction~~ light-extraction surfaces being distant from said outer side faces, interfacing with a translucent non-semiconductor medium, meeting at least one of said upper and lower faces and inclined to said upper face.

93. **(Previously added)** An LED lamp according to claim 92 wherein said ~~lightextraction~~ surfaces each cut into both of said lower and upper semiconductor layers.

94. **(Previously added)** An LED lamp according to claim 92 wherein said conductor layer is of metal.

95. **(Previously added)** An LED lamp according to claim 94 wherein said conductor layer of metal is light-passing.

96. **(Previously added)** An LED lamp according to claim 92 including a layer of material translucent to visible light and of lower refractive index than said lower semiconductor layer under the lower

semiconductor layer, and including a semiconductor substrate of higher refractive index than said layer of translucent material below the layer of translucent material.

97. **(Previously added)** An LED lamp according to claim 92 wherein said light extraction surfaces are oblique to said upper face.

98. **(Previously added)** An LED lamp according to claim 92 including a nonsemiconductor substrate that is translucent to visible light and over which said semiconductor structure is grown.

99. **(Previously added/Currently amended)** An LED lamp according to any of claims 38, 53, 56, 64, 66, 68, 70, 75, 84 or 92 including a sapphire substrate on which said semiconductor structure is grown.

100. **(Previously added/Currently amended)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising: a lower semiconductor layer having a lower face thereof; an upper semiconductor layer grown over said lower semiconductor layer and having an upper face thereof, said lower and upper semiconductor layers forming a diode; and an active region between said layers generating light a substantial proportion of which propagates parallel to said active region guided by internal reflections at said upper and lower faces, said structure having outer side faces surrounding the structure;

a conductor layer ~~covering and~~ in electrical contact with substantially all of the top of said upper semiconductor layer;

at least one metal conductor electrically ~~connected~~ in contact with
an underlying portion of said lower semiconductor layer;

means harvesting vertical light from said active region; and

~~wherein said semiconductor structure has a plurality of cavities
distant from said outer side faces, each extending from said upper face
and each terminating at a floor that is above said lower face and below
said active region, side walls of the cavities diverting said guided light.~~

wherein said semiconductor structure has a plurality of cavities
distributed about the structure for release of the guided light; each of the
cavities extending down from said upper face, terminating at a floor that
is below said active region, and containing a non-semiconductor medium;
side walls of the cavities diverting said guided light.

101. **(Previously added)** An LED lamp according to claim 100
wherein said side walls are oblique to said lower face, whereby release of
guided light is enhanced.

102. **(Previously added)** An LED lamp according to claim 100
wherein said side walls are sides of separate LEDs that are driven
together.

103. **(Previously added)** An LED lamp according to claim 100
wherein said lower semiconductor layer comprises a sub-layer of low
resistivity.

104. **(Previously added)** An LED lamp according to claim 100
wherein said side walls pass light.

105. **(Previously added)** An LED lamp according to claim 100
including: a first conductor on said semiconductor structure; a second

conductor on said semiconductor structure crossing over said first conductor; and insulation preventing electrical contact between the first and second conductors.

106. **(Previously added)** An LED lamp according to claim 100 wherein each of said cavities contains a metal floor-conductor on the cavity floor, each floor-conductor feeding current to portions of said semiconductor structure that are on opposite sides of the floor conductor and the floor-conductors in the cavities feeding current to said lower semiconductor layer together when the lamp is turned on.

107. **(Previously added)** An LED lamp according to claim 100 wherein said semiconductor structure includes a plurality of LEDs the tops of which are electrically joined together by an opaque conductor.

108. **(New)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising: a lower semiconductor layer having a lower face thereof; an upper semiconductor layer having an upper face thereof, said lower and upper semiconductor layers forming a diode; and an active region between said layers generating light; said structure having an outer side faces surrounding the structure;

means harvesting vertical light from said active region;

at least one conductor in electrical contact with said lower semiconductor layer;

a conductor layer covering and in electrical contact with said upper semiconductor layer;

thin light-passing dielectric material covering said conductor layer;
an opaque reflector covering said light-passing dielectric material;
and

wherein said semiconductor structure is formed to have light-diverting surfaces distributed about the structure for release of light from the semiconductor structure, each distant from said side faces, inclined to said semiconductor layers, and meeting at least one of said upper and lower faces.

109. **(New)** An LED lamp according to claim 108 wherein said upper semiconductor layer is grown over said lower semiconductor layer.

110. **(New)** An LED lamp according to claim 108 provided with several spaced-apart metal parts above said upper semiconductor layer for cooling said active region.

111. **(New)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising: a lower semiconductor layer having a lower face thereof and an upper semiconductor layer having an upper face thereof, said lower and upper semiconductor layers forming a diode; and an active region between said layers generating light;

distributed opaque conductors each in electrical contact with said lower semiconductor layer and each positioned between light generating parts of said structure as viewed normal to said active region;

reflector means at said upper face reflective to light from said active region incident thereon at 45 degrees; and

wherein said semiconductor structure has several light-generating portions at least partly separated from each other by light-diverting surfaces that extend from said upper face into the lower semiconductor layer, at least one of the light-diverting surfaces being at an obtuse angle to said upper face measured through semiconductor, and each of said light-diverting surfaces deflecting light that has been generated by an associated portion of said active region and reflected by said reflector means, the deflected light striking said lower face on its way to contributing to light output from the lamp;

wherein each of the LED portions has a conductor part thereon for energizing the upper semiconductor layer,

wherein upward and downward light generated in said portions are harvested; and

wherein interconnection is provided for causing currents to flow through said conductor parts and said opaque conductors together when the lamp is turned on.

112. **(New)** An LED lamp according to claim 111 wherein said light-diverting surfaces are side walls of trenches.

113. **(New)** An LED lamp according to claim 112 including a conductor on said semiconductor structure that is electrically connected to said upper semiconductor layer and that crosses at least one of said trenches.

114. **(New)** An LED lamp according to claim 113 wherein the crossed trench contains a conductor track electrically connected to said lower semiconductor layer.

115. **(New)** An LED lamp according to claim 111 including metallic reflectors at said light-diverting surfaces.

116. **(New)** An LED lamp according to claim 111 including a heat sink above said semiconductor structure for cooling said active region.

117. **(New)** An LED lamp according to claim 111 including a conductor layer covering and in electrical contact with said upper semiconductor layer.

118. **(New)** An LED lamp according to claim 111 wherein a pair of said light diverting surfaces are separated by a space devoid of semiconductor.

119. **(New)** An LED lamp according to claim 111 wherein said opaque conductors are parts of a grid.

120. **(New)** An LED lamp according to claim 111 wherein said semiconductor structure has a refractive index of at least 3.

121. **(New)** An LED lamp according to claim 111 wherein said upper semiconductor layer is formed over said lower semiconductor layer.

122. **(New)** An LED lamp according to claim 111 wherein said obtuse angle is more than 110 degrees.

123. **(New)** An LED lamp according to claim 111 including an opaque reflector above said upper semiconductor layer for reflecting back into that layer upward light from said active region.

124. **(New)** An LED lamp according to claim 111 wherein said conductor layer is light-passing.

125. **(New)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising a lower semiconductor layer having a lower face thereof and an upper semiconductor layer having an upper face thereof, said lower and upper semiconductor layers forming a diode and an active region between said layers generating light, said structure having outer side faces surrounding the structure and a plane generally parallel to said lower face defining a reference plane;

means harvesting upward and downward vertical light from said active region;

at least one metal conductor on said semiconductor structure electrically connected with said upper semiconductor layer;

a plurality of spaced-apart conductors on said semiconductor structure each for energizing an associated underlying portion of said lower semiconductor layer and each being distant from said outer side faces and positioned between light generating portions of said semiconductor structure as viewed normal to said reference plane; said semiconductor structure being arranged to have several light-extraction surfaces distributed about the semiconductor structure for enhancing release of light from the semiconductor structure, the light-extraction surfaces being distant from said outer side faces and inclined to said reference plane; and

electrical connection for causing said spaced-apart conductors to pass current to said lower semiconductor layer together when the lamp is turned on.

126. **(New)** An LED lamp according to claim 125 wherein said upper semiconductor layer is p-type and is covered and in electrical contact with a conductor layer.

127. **(New)** An LED lamp according to claim 126 wherein said semiconductor structure comprises light-generating portions (E, TE) that are at least partly delineated by conductor tracks that energize said lower semiconductor layer.

128. **(New)** An LED lamp according to claim 126 wherein each of said light-extraction surfaces is in contact with a non-semiconductor medium.

129. **(New)** An LED lamp according to claim 126 wherein said light-extraction surfaces are side walls of cavities in the semiconductor structure containing material having a refractive index less than 1.4, and wherein the side walls are inclined to said upper face by an obtuse angle as measured through semiconductor.

130. **(New)** An LED lamp according to claim 126 including a member serving at least as a heat sink for the semiconductor structure, said member being above the semiconductor structure.

131. **(New)** An LED lamp according to claim 126 including several spaced metallic parts passing heat from said semiconductor structure to said member.

132. **(New)** An LED lamp according to claim 126 wherein a plane normal to said layers cuts at least four of said light-extraction surfaces.

133. **(New)** An LED lamp according to claim 125 wherein said light-diverting surfaces are in contact with a medium having a refractive index less than 1.4.

134. **(New)** An LED lamp according to claim 125 wherein said light-diverting surfaces are side walls of trenches.

135. **(New)** An LED lamp according to claim 134 wherein said trenches contain metallic reflectors.

136. **(New)** An LED lamp for generating incoherent visible light, comprising:

an inorganic semiconductor structure comprising a lower semiconductor layer having a lower face thereof and an upper semiconductor layer having an upper face thereof, said lower and upper semiconductor layers forming a diode and an active region between said layers generating light, said structure having outer side faces surrounding the structure and a plane generally parallel to said lower face defining a reference plane;

means harvesting upward and downward vertical light from said active region;

a conductor layer covering and in electrical contact with said upper semiconductor layer;

a plurality of trenches in said semiconductor structure each extending from said upper face into said semiconductor structure and each containing a metal track at least part of which is in electrical contact with said lower semiconductor layer; said semiconductor structure having several light-extraction surfaces distributed about the semiconductor

structure for enhancing release of light from the semiconductor structure, said light-extraction surfaces being distant from said outer side faces and inclined to said reference plane, LED light propagating in the semiconductor structure being diverted at said light-extraction surfaces; and

electrical connection for causing said tracks to pass current together when the lamp is turned on.

137. **(New)** An LED lamp according to 136 including reflectors in said trenches that are oblique to said reference plane.

138. **(New)** An LED lamp according to claim 38 wherein said cavities are trenches.

139. **(New)** An LED lamp according to claim 38 including trenches in said semiconductor inclined one to another.

140. **(New)** An LED lamp according to claim 56 wherein said spaced-apart conductor parts are above said lower face.

141. **(New)** An LED lamp according to claim 92 including first and second trenches in said semiconductor structure that are inclined one to the other, at least one of trenches containing a metallic part that is in electrical contact with said lower semiconductor layer.

142. **(New)** An LED lamp according to claim 92 including a trench in said semiconductor structure cutting through the active region from said upper face, and including a conductor that is in electrical contact with said upper semiconductor layer and that crosses the trench.

143. **(New)** An LED lamp according to claim 100 wherein each of said side walls diverts a beam of light as a beam.

144. **(New)** An LED lamp according to claim 100 wherein said cavities contain metallic reflectors that deflect light generated by said active region.

145. **(New)** An LED lamp according to any of claims 38, 77, 78 or 111 wherein said semiconductor structure has a refractive index of at least 3.

146. **(New)** An LED lamp according to any of any of claims 38, 56, 111 or 136 including a substrate that is electrically non-conducting and over which at least one of said semiconductor layers has been grown.

147. **(New)** An LED lamp according to any of claims 100, 108, 111, 125 or 136 including a sapphire substrate over which at least one of said semiconductor layers has been grown.

148. **(New)** An LED lamp according to any of claims 38, 56, 92, 125 or 136 wherein each of said light-extraction surfaces diverts a beam of light as a beam.

149. **(New)** An LED lamp according to claim 108 or 111 wherein each of said light-diverting surfaces diverts a beam of light as a beam.

150. **(New)** An LED lamp according to any of claims 38, 53, 56, 60, 64, 75, 77, 78, 81, 92, 100, 108, 111, 125 or 136 wherein said semiconductor structure comprises a layer that is a nitride of at least gallium.

151. **(New)** An LED lamp according to any of claims 38, 53, 56, 60, 64, 75, 77, 78, 81, 108, 111, 125 or 136 wherein said semiconductor structure is at least part of a chip.

152. **(New)** An LED lamp according to any of any of claims 38, 56, 92, 125 or 136 wherein each of said surfaces distant from said outer side faces is of a predetermined area and is placed at an associated predetermined position of said semiconductor structure.

153. **(New)** An LED lamp according to any of claims 38, 56, 60, 64, 111, 125 or 136 including a substrate having top face over which said semiconductor structure is grown and wherein light generation in said semiconductor structure extends over an area substantially the same as that of said substrate top face.

154. **(New)** An LED lamp according to any of claims 38, 56, 111 or 136 including at least one trench that extends from said upper face through said active region and that is crossed by a conductor that electrically contacts said upper semiconductor layer.

plg
Circu